Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

various countries, but such evidence as I have here outlined strongly supports the hypothesis that our three form-species of lettuce have originated from wild forms which have been brought into culture in different regions, and hence that our three form-species have different origin. The history of lettuce as published affords no clue towards settling this point. Lettuces are supposed to have been grown by the Persians some five hundred years before Christ, and to have been introduced into China between the years 600 and 900 of our era; they were mentioned by Chaucer in England in the fourteenth century, and reached America with Columbus.

——:o:——

AQUATIC RESPIRATION IN SOFT-SHELLED TURTLES: A CONTRIBUTION TO THE PHYSIOLOGY OF RESPIRATION IN VERTEBRATES.[1]

BY SIMON H. AND SUSANNA PHELPS GAGE.

IT was formerly supposed that in all reptiles the respiration was exclusively aërial at all periods of their life, and that the lungs were the only respiratory organs. We have demonstrated, however, that in soft-shelled turtles (*Amyda mutica* and *Aspidonectes spirifer*) there is in addition a true aquatic respiration. This is *indicated* by three facts: (*a*) These turtles remain most of the time in water, and voluntarily remain entirely under from two to ten consecutive hours; (*b*) while under water they fill and empty the mouth and pharnyx, about sixteen times per minute, by movements of the hyoid apparatus, the general appearance being like the respiratory movements of a fish; (*c*) the mucous membrane of the pharynx is closely beset with filamentous processes, appearing like the villi of the small intestine of a mammal or the gill filaments of Necturus. These processes are especially numerous along the hyoid arches and around the glottis, and are copiously supplied with blood.[2]

---

[1] A preliminary paper upon the respiration of Aspidonectes was presented to the A. A. A. S. by the senior author in 1883, and printed on p. 316 of the Proceedings (Vol. XXXII).

[2] So far as we know but two original observations (besides that mentioned in the preceding foot-note) have been previously made upon the Trionychidæ bearing upon the subject of this paper: (*a*) In February, 1856, Dr. A. Sager called attention to the processes in the pharynx of Aspidonectes, and compared them, in appearance, with the gill filaments of Necturus and the inner gills of tadpoles. (*b*) Professor L.

But neither the time the turtles remain under water, the filling and emptying of the mouth and pharynx with water, nor even the structure of the parts, proves that aquatic respiration occurs. Final proof of this is only obtained by comparing the free gases found in water with those found in water from the same source after a turtle had been submerged in it without access to air. Water so tested showed in one case that a turtle weighing one kilogram in ten hours removed from the water seventy-one milligrams of free oxygen and added to it 318 milligrams of carbon dioxide. Several other determinations were of the same conclusive character.[1]

This indicates a respiration for the same body weight of about one twentieth of that occurring in man.

As indicated by the figures given above, the carbon dioxide is greatly in excess of what could be accounted for by the free oxygen taken from the water. There are two sources from which the extra oxygen might be derived: (*a*) From the so-called intra-

Agassiz, in Part II of the Contribution to North American Zoölogy, p. 284, says: "Before reading this paper [Dr. Sager's] we had noticed these organs [processes in the pharynx]; but after seeing this turtle [Aspidonectes] remaining under water for full half an hour without showing the least sign of oppression, it seems plausible to assume that these fringes may be similar to the internal gills of tadpoles, not only in their shape but also in their function. There exists, moreover, an extensive network of beautiful vessels spreading in elegant dendritic ramifications upon the whole lower surface of the Trionycidæ which can hardly have another function than that of assisting in the process of breathing, as they are too numerous and too large to be considered simply as nutritive vessels of the skin. This is the more probable as these vessels are very superficial and are only covered by a very thin epidermis. They are indeed as plainly visible through the horny layer which protects them as the vessels of any special external breathing organ." * * *

---

[1] The following table shows the results of three analyses. In the first column is given the total amount of free oxygen taken from the water (ten liters) in ten hours by a turtle weighing one kilogram. The second column contains the quantity of carbon dioxide that could be formed from this oxygen; and the third column contains the actual amount of carbon dioxide added to the water by the turtle, the excess of which, over the amount that could be formed from the oxygen taken from the water, is given in the fourth column:

	O.	CO_2.	*Actual* CO_2.	*Excess* CO_2.
July 11......	71 mg.	97 5-8 mg.	231 mg.	133 3-8 mg.
Aug. 8......	32 "	44 "	212.7 "	168.7 "
Aug. 9......	39 "	53 5-8 "	168.7 "	115 3-40 "

The determinations were made with the greatest care and accuracy by Professors Rich and Holton in the chemical laboratory of Cornell University.

molecular oxygen stored up in the tissues, and (*b*) from the air in the lungs. Analysis of the air taken from the lungs after the turtle had been wholly submerged for ten hours, showed only a slight trace of either oxygen or carbon dioxide. So far as this single experiment goes, we conclude that if the lungs were moderately filled with air upon the immersion of the turtle, the amount of oxygen that might be taken from the air in the lungs would fully account for the excess of carbon dioxide found in the water. That the aquatic respiration is due almost entirely to the pharynx and but slightly to the skin, is shown: (*a*) By anæsthetization, the turtle becoming anæsthetized four or five times as quickly when kept entirely submerged in ætherized water as when allowed to come to the surface as frequently as it desired. (*b*) When the turtle's skin was completely covered with vaseline and the turtle kept wholly submerged, the amount of oxygen removed from the water and of carbon dioxide added thereto was nearly as great as when the skin was unvaselined.

In some at least of the hard-shelled turtles (Chelydra and Chrysemys) similar movements of the hyoid apparatus occur when they are submerged, and water is seen to enter the nostril and be expelled therefrom as in soft-shelled turtles.

The pharynx expands and contracts with considerable regularity in all of the turtles, so far as we know, when they are in the air. These movements appear like those of the frog, but in the turtles they are unnecessary for filling the lungs. In frogs, however, they are necessary for this purpose, although as shown by Townson (1794), pharyngeal movements often occur in the frog without any air being forced into the lungs.

As these movements are of undoubted use in respiration for the soft-shelled turtles in water, it seems probable that they may be of use in respiration for all turtles in the air, that is, the membrane lining the pharynx probably acts as a respiratory organ whether the medium bathing it and containing free oxygen be air or water.

These movements and their object, respiration, then seem to connect, physiologically at least, the turtles on the one hand with the lower vertebrates—Amphibia and fishes—and on the other hand with the higher forms, viz., dog and man, for Garland has shown that in the dog, and also in man, occur rhythmical pharyngeal movements which draw air into the pharynx and expel it whenever there is a condition approaching asphyxiation. It seems as though these pharyngeal movements reappear in the highest forms when the want of oxygen becomes overwhelmingly great, as if there were an organic memory of the means by which, in the dim past, the want was supplied.

——:o:——

DESCRIPTION OF A NEW SUBSPECIES OF THE COMMON EASTERN CHIPMUNK.

BY C. HART MERRIAM, M.D.

THE common chipmunk or striped squirrel of Eastern North America was first mentioned, so far as I have been able to ascertain, by Sagard-Théodat in his Histoire du Canada ("Vol. v, p. 746"), published in 1615. In 1743 Mark Catesby gave an unmistakable description of it, accompanied by a recognizable colored plate.[1] He called it *Sciurus striatus*, which name was adopted by Linnæus in the tenth edition of his Systema Naturæ, published in 1758. The specific name *striatus*, after enduring the vicissitudes to which scientific nomenclature is so often subject,[2] was reëstablished by Baird in 1857, and has since enjoyed undisputed recognition on this side of the Atlantic.

It is a little singular that thus far no one seems to have suspected the existence of two distinct subspecies of chipmunk in Eastern North America, particularly when it is remembered that no less than five geographical races of the Western species have long been recognized.

It is true that Professor Baird, nearly thirty years ago, stated that a chipmunk from Essex county, in Northeastern New York,

---

[1] "SCIURUS STRIATUS. *The Ground Squirrel.* This is about half the Size of an English Squirrel, and almost of the same Colour, except that a Pair of black Lists, with a yellowish white List between them, extend almost the Length of the Body on both Sides; also a single black List runs along the Ridge of the Back. The Eyes are black and large, the Ears rounding, the Tail long, flat, and thick set with Hairs, which are much shorter than those of other Squirrels. These Squirrels abide in the Woods of *Carolina*, *Virginia*, &c. Their Food is Nuts, Acorns, and such like as other Squirrels feed on. They being brought up tame, are very familiar and active." (Natural Hist. of Carolina, etc., by Mark Catesby, Vol. II, 1743, p. 75).

[2] For more than half a century our animal was confused with the Asiatic, but it is not the purpose of the present paper to enter into a discussion of the complicated synonymy of these species, already very fully elaborated by Allen. (Monographs of North American Rodentia, 1877.)